



PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference JTSD/P13668PC	FOR FURTHER ACTION		See Form PCT/IPEA/416
International application No. PCT/GB2004/003151	International filing date (day/month/year) 19.07.2004	Priority date (day/month/year) 18.07.2003	
International Patent Classification (IPC) or national classification and IPC B01D53/32, A61L9/22, F24F3/16, H01T23/00, C01B13/11, H01T19/00			
Applicant HALLAM, David Richard			
<p>1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.</p> <p>2. This REPORT consists of a total of 7 sheets, including this cover sheet.</p> <p>3. This report is also accompanied by ANNEXES, comprising:</p> <p style="margin-left: 20px;">a. <input checked="" type="checkbox"/> sent to the applicant and to the International Bureau) a total of 3 sheets, as follows:</p> <p style="margin-left: 40px;"><input checked="" type="checkbox"/> sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).</p> <p style="margin-left: 40px;"><input type="checkbox"/> sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.</p> <p style="margin-left: 20px;">b. <input type="checkbox"/> (sent to the International Bureau only) a total of (indicate type and number of electronic carrier(s)) , containing a sequence listing and/or tables related thereto, in computer readable form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).</p>			
<p>4. This report contains indications relating to the following items:</p> <p><input checked="" type="checkbox"/> Box No. I Basis of the opinion</p> <p><input type="checkbox"/> Box No. II Priority</p> <p><input type="checkbox"/> Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability</p> <p><input type="checkbox"/> Box No. IV Lack of unity of invention</p> <p><input checked="" type="checkbox"/> Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement</p> <p><input type="checkbox"/> Box No. VI Certain documents cited</p> <p><input checked="" type="checkbox"/> Box No. VII Certain defects in the international application</p> <p><input type="checkbox"/> Box No. VIII Certain observations on the international application</p>			
Date of submission of the demand 18.05.2005		Date of completion of this report 26.10.2005	
Name and mailing address of the International preliminary examining authority:  European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465		Authorized Officer Eijkenboom, A Telephone No. +49 89 2399-8616 <div style="text-align: right;">  </div>	

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International application No.
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Box No. I Basis of the report

1. With regard to the **language**, this report is based on the international application in the language in which it was filed, unless otherwise indicated under this item.
 - ☐ This report is based on translations from the original language into the following language , which is the language of a translation furnished for the purposes of:
 - ☐ international search (under Rules 12.3 and 23.1(b))
 - ☐ publication of the international application (under Rule 12.4)
 - ☐ international preliminary examination (under Rules 55.2 and/or 55.3)
2. With regard to the **elements*** of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report)*:

Description, Pages

1-53 as originally filed

Claims, Numbers

1-16 filed with telefax on 18.05.2005

Drawings, Sheets

1/3-3/3 as originally filed

- ☐ a sequence listing and/or any related table(s) - see Supplemental Box Relating to Sequence Listing

3. ☐ The amendments have resulted in the cancellation of:

- ☐ the description, pages
- ☐ the claims, Nos.
- ☐ the drawings, sheets/figs
- ☐ the sequence listing (*specify*):
- ☐ any table(s) related to sequence listing (*specify*):

4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).

- ☐ the description, pages
- ☐ the claims, Nos.
- ☐ the drawings, sheets/figs
- ☐ the sequence listing (*specify*):
- ☐ any table(s) related to sequence listing (*specify*):

* If item 4 applies, some or all of these sheets may be marked "superseded."

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Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes: Claims	
	No: Claims	1-16
Inventive step (IS)	Yes: Claims	
	No: Claims	1-16
Industrial applicability (IA)	Yes: Claims	1-16
	No: Claims	

2. Citations and explanations (Rule 70.7):

see separate sheet

Box No. VII Certain defects in the international application

The following defects in the form or contents of the international application have been noted:

see separate sheet

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(SEPARATE SHEET)**

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18 JAN 2006
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Ad Section VII:

1. As a preliminary remark, it is noted that, contrary to the indications in the reply to the written opinion of the International Preliminary Examination Authority, no amendment to claim 1 could be distinguished.

Moreover, the references as mentioned in the reply to the passages in the originally filed description do not provide support for amendments to any of the amended claims.

2. It is furthermore noted that the currently valid set of claims comprise two claims numbered 14 and, hence, the currently valid set of claims actually comprises **17** claims.
3. The features of the claims are not provided with reference signs placed in parentheses (Rule 6.2(b) PCT).

Ad section V:

1. Claim 1 is directed to an apparatus which, thus, is and can only be defined by apparatus features.

The essential apparatus features defining the apparatus of claim 1 are:

- (a) a low power corona discharge ozone generator
inside
- (b) a chamber with inlet and outlet
and
- (c) at least one air flow impeller
- (d) in absence of an ozone decomposition catalyst.

The remaining wording of claim 1 is directed to the suitability of the apparatus for air treatment or to the result to be achieved by the apparatus without, however, presenting or imposing additional apparatus features to the device of claim 1. In other words, any prior art device comprising the same apparatus features as the cartridge

of claim 1 and suitable for the same purpose would prejudice the novelty of the subject-matter of the claim.

2. In relation to the discussion of the prior art documents, reference is made to the passages cited in the International Search Report.
- 2.1 EP 1 348 448 A (D1) refers to an air conditioning apparatus comprising fan, filters and an *alternating-current* plasma discharge ion and ozone generator whereby the level of ozone exhausted the apparatus is kept at an acceptable level (paragraphs 40-41, 302-303). The skilled person sees no substantial technical difference between plasma discharge and corona discharge. In addition, it is technically irrelevant whether ozone is produced as a main product or as a byproduct since the essence lies in the fact that ozone is produced by the apparatus in D1 and assists in the sterilisation of the air (paragraph 303). In analogy with current application, the device of D1 is operated in such a way that to emissions of ions and ozone are kept at an acceptable level by changing the operating conditions of the plasma discharge generator whereby the presence of a catalyst is not considered mandatory (paragraph 305).

Hence, as the device of D1 comprises all the essential features of the device of claim 1, the subject-matter of claim 1 is not novel (Art.33(2) PCT).

- 2.2 GB 2 358 350 A (D2) discloses an air purification device comprising low power corona discharge ozone generator and air flow impeller, hence the device comprises all apparatus features of claim 1. The applicant has submitted that the apparatus of D2 fails to control the concentration of ozone in the expelled air at an acceptable level. It is noted, however, that this feature appears in claim 1 only as a result to be achieved whereby any indication to a tangible means for controlling the exhausted ozone is lacking. Hence, the device of D2 either falls under the wording of claim 1 (Art.33(3) PCT) or essential features are missing in the claim (Art.6 PCT) or, more critically, the invention is not sufficiently disclosed (Art.5 PCT).

Notwithstanding the above, it would be an obvious incentive to the skilled person to

operate the apparatus of D2 in such a way that the concentration of ozone exhausted from the device is kept at an acceptable level. Consequently, even if claim 1 were novel over D2, the claim lacks inventive step (Art.33(3) PCT).

- 2.3 WO 03/028880 A (D3) discloses an air purification module comprising an electric discharge coronal plasma generator and a fan. The device is suitable for keeping the exhausted ozone concentration at an acceptable level. Since D3 explicitly indicates that the plasma generator produces ozone (paragraph 51) and that the concentration of such reactive oxidative species effect sterilisation more rapidly (paragraph 53), it is not understood how the plasma generator cannot be considered an ozone generator. The optional scrubber is only necessary if the ozone level exhausted becomes unacceptable and cannot be considered as an ozone decomposition catalyst.

Consequently, since the device of D3 discloses the features of claim 1, the latter also lacks novelty over this document (Art.33(2) PCT).

- 2.4 US 5 087 428 A (D4) discloses a cartridge-like air purification system comprising fan, electric discharge O₃ generator followed by corona generator, both generators comprising concentric tubular metal gauze electrodes separated by TiO₂ glass dielectric.

US 2003/131439 A1 (D5) discloses cartridge filtration system for vacuum cleaners comprising first passive stage (filter), a second active stage containing ozone generation by electric discharge and a fan.

EP 0 824 041 A (D6) discloses a portable personal corona discharge air purification device comprising a filter, a fan and a generator producing O₃.

Since each of these devices indeed comprises all apparatus features of claim 1 as well as maintains the concentration of expelled ozone at an acceptable level without the use of an ozone decomposition catalyst, the disclosure in either one of D4, D5 and D6 prejudices the novelty of claim 1 (Art.33(2) PCT).

3. In the light of the prior art as cited above, dependent claims 2-6 do not contain

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any features which, in combination with the features of any claim to which they refer, meet the requirements of the PCT in respect of novelty and/or inventive step (Article 33(2) and (3) PCT).

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IAP20 Rec'd PCT/PTO 18 JAN 2006

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CLAIMS

1. An apparatus for the treatment of air comprising a low power corona discharge ozone generator mounted inside a chamber having an air inlet and an air outlet and at least one air flow impeller formed and arranged for inducing a flow of air through said chamber, said ozone generator being formed and arranged for generating a restricted concentration of ozone and any other reactive species formed together therewith, within an inactivating zone contained within said chamber, through which said air flow is passed in use of said apparatus, which restricted concentration is sufficient effectively to inactivate airborne pollutant material entrained in said air flow, yet which restricted concentration decays sufficiently outside said inactivating zone so that the concentration of ozone in the cleaned air expelled from said apparatus is at a physiologically acceptable level without the use of an ozone decomposition catalyzer.

2. The apparatus of Claim 1 wherein said low power corona discharge ozone generator comprises a low power corona discharge device provided with a low power high voltage output transformer.

3. The apparatus of Claim 2 wherein the low power corona discharge device comprises concentric tubular metal gauze electrodes separated by a tubular strengthened glass dielectric.

4. The apparatus of Claim 3 wherein the glass dielectric is of titanium dioxide strengthened borosilicate glass.

5. An apparatus according to any one of claims 1 to 4 wherein the low power corona discharge ozone generator has a power rating of from 4 to 50 watts.

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6. An apparatus according to any one of claims 1 to 5 wherein said air flow impeller is formed and arranged so as to provide a flow rate of air through the apparatus in the range 50-2500 m³ per hour
7. An apparatus according to any one of claims 1 to 6 wherein said at least one inlet is fitted with at least one filter.
- 10 8. An apparatus according to claim 7 wherein is provided at least one filter for removing tobacco smoke oil and/or tar.
9. An apparatus according to any one of claims 1 to 8 wherein said at least one outlet is fitted with at least one filter.
- 15 10. An apparatus according to any one of claims 7 to 9 wherein is provided an electrostatic filter.
11. An apparatus according to any one of claims 7 to 10 wherein the inlet and outlet are disposed in proximity to each other and the apparatus provided with a single filter mounting so that respective portions of the filter occlude respective ones of the inlet and outlet.
- 25 12. An apparatus according to any one of claims 1 to 11 wherein is used for said alternating current corona discharge ozone generator, an AC supply with a frequency in the range from 50 to 1000 Hz.
- 30 13. An apparatus according to any one of claims 1 to 12 wherein is used an AC supply with an operating voltage in the range from 1 to 6 kV.

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14. An apparatus according to any one of claims 1 to 13 wherein is used an AC supply providing a (starting) current in the range from 1 to 10 mA.

- 5 14. An apparatus according to any one of claims 1 to 13 wherein is used an air flow impeller formed and arranged for inducing a flow of air through said chamber, in use of the apparatus, which air flow has a residence time in said chamber in the range from 0.2 to 20 seconds.

- 10 15. An apparatus according to any one of claims 1 to 14 wherein is used a low power corona discharge device with a solid dielectric.

- 15 16. A method of cleaning air without the use of an ozone decomposition catalyzer, comprising the steps of:
providing an apparatus according to claim 1;
powering the ozone generator of said apparatus so as to generate ozone in the inactivation zone of said apparatus; and operating
20 said airflow impeller so as to pass a flow of said air through said inactivation zone.